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By- Sapon, Stanley M.

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At the Child Language Development Center at the University of Rochester, basic research in children's verbal behavior and the exploration of procedures for extending successful laboratory techniques to the typical preschool setting are being continued. Experiments in contingency management and the establishment of requisite antecedent behaviors such as sitting, listening, etc. necessary for preschool activities are being conducted. The Center's operation is based on the theory that verbal behavior as well as other behaviors can be engineered when supportive consequences are contingent upon production of desired behavior. A behavior is introduced to an individual child in a special setting by a teacher. Once the desired behavior has been learned, the child is returned to the "natural" playroom setting where it has been demonstrated that he will again repeat the learned behavior without additional instruction. (MS)

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ENGINEERING VERBAL BEHAVIOR

Stanley M. Sapon

Professor of Psycholinguistics
and Psychology

University of Rochester

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Stanley M. Sapon

University of Rochester

My dictionary defines "engineering" as the "art or science of making practical application of the knowledge of pure sciences such as physics, chemistry, biology, etc." Whether behavioral science is omitted by design or simply left to fall into the "etcetera" is a matter that highlights the common concern that brings us together at this conference. The guidelines for contributors emphatically made the point that we were to be less concerned with the "discussion" of the problems involved in the teaching of young children than with the elaboration of solutions to what are considered to be clearly identified problems.

That this signals an "engineering" approach is clear, and it is my intention to explore the implications of such an approach for the teaching of young children in general, and to present a sample of engineered solutions to a specific problem in verbal behavior.

An engineer can develop a working technology that is derived from a science only in proportion to the degree that that science has defined its problem area. Good definitions are those that permit us to meet what is perhaps the most

crucial criterion of experimental science -- replicability. A scientist suspects he is on the right track when he can reliably duplicate his results in his own laboratory. That is another way of saying that he can both predict and control what will happen in his experimental set-up. If his published results can be repeated in someone else's laboratory, it means that he has not only defined a problem clearly, but also has included in his report a sufficiently detailed account of the necessary conditions for his results to be duplicated.

While the engineer may be less concerned with the first of the scientist's goals -- the quest for basic scientific elements -- he is equally concerned with the second -- i.e., an account of what he has done that is sufficiently detailed to permit the duplication of his successes by others. An engineering drawing is reliable and repeatable when the engineer has given all the "specifications" that must be followed if his design is to perform as promised.

Specification of materials, process, sequence, etc. is not the only problem that confronts an engineer when he seeks to apply the products of science. One of his most difficult problems derives from the fact that the scientist's laboratory represents a highly refined environment in which the experimenter can, or attempts to, control with great precision the variables that appear to be relevant.

The engineer, however, is required to achieve the goal of repeatability not in the laboratory, but in the "real world" -- that is to say, an environment most prominently characterized by its admixture of random elements, and the difficulty of excluding elements that may be incompatible with, or even hostile to, his design objectives.

If the engineer confronts a thorny problem with regard to the description of his process, he is at least spared the task of defining his product.

It is in the area of product definition that, in fact, the engineer has a distinct advantage over those who seek to develop an educational technology. The engineer must know -- indeed cannot even begin his work until he is told -- what his product is to do, under what conditions it is expected to perform, what reliability is to be required, and under what stresses it is to function. Such product definitions are rare in educational circles.

Let us draw our analogy to a close with an engineer's look at "the problems in the teaching of young children." The "product" we are concerned with is the behavior of young children, and the "process" is both the educational environment and what takes place in it.

"Specifications" for the behavioral "product" are most frequently couched in terms describing values or properties that are of little help in establishing the properties.

Declaring the importance of "curiosity" or "respect for others" or the "ability to express one's self" is about as useful a set of specifications as telling an engineer to build a bridge that "looks esthetically satisfying," and "can carry heavy traffic."

Similarly, "specifications of process" have tended toward instructions so loose as to guarantee a range of variability in application so broad that poor reliability and repeatability are ensured. One of the central problems here derives from the fact that methodology is most often presented in terms of <u>strategy</u> rather than <u>tactics</u>. Preparing children for reading has been elaborated in <u>strategic</u> terms, such as directing kindergarten teachers to "prepare children to discriminate shapes and dimensions" as antecedent to discriminating the forms of letters or words. The <u>tactics</u>, the actual "how-to" instructions for dependably achieving behavioral objectives, receive woefully little attention, in spite of the fact that the success of a strategy is totally dependent on the tactics used to implement it. Strategy may represent the contact between the theoretician and the teacher, but tactics correspond to the interface between teacher and pupil.

I want to report today on a small sample of a larger effort to establish specified repertoires of verbal behavior

in very young preschool children, and to present this report in terms of tactics as well as strategies.

Although the kinds of "blueprints" that have been developed for establishing a given repertoire are sufficiently detailed to meet an engineering criterion of reliability and repeatability, I believe their general utility may be enhanced by a brief sketch of the scientific principles that underlie the analysis of the problems, that direct the rationale for the strategy, and that provide the basis for the tactics.

The overall description and specification of target behaviors in early childhood education is prominently characterized by ambiguities and generalities, but perhaps the highest level of ambiguity is found in the specification of verbal behavior. There are many reasons for this, and we will look at a few of them. Foremost is the difficulty in evaluating a child's verbal behavior on objective criteria. Indeed, the notion of objectivity is, to a large extent, a paradoxical one, since the functional effectiveness of a child's verbal repertoire is measured against the highly variable verbal repertoires of adults. We can measure the functional effectiveness of a child's digital and manipulatory behavior against standard blocks and crayons, but there is no "standard human being" against whom to test a child's verbal repertoire.

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Difficulties in evaluating verbal behavior are intensified by the fact that what is considered to be "verbal behavior" is pedagogically obscure. There is a tendency to regard verbal behavior as "language behavior," and "language behavior" is seen as what people <u>say</u> as discrete from what people <u>do</u>. This haziness of definition, which leads among other things to hollow disputes over "cognition," can be resolved by adopting a different analytical tack. We need to see the problem as one of distinguishing two <u>different</u> repertoires of verbal behavior -- a receptive repertoire and a productive repertoire.

"Receptive language" can be seen as evidence that a human being is under the control of someone else's verbal behavior. "Productive language" is evidenced when we see someone controlling his environment verbally. If you should say to me "Please pass the salt," you would be displaying a fragment of your productive repertoire. When I pick up the salt shaker and give it to you, I am displaying a fragment of my receptive repertoire. In other words, "productive language" is <u>verbal controlling</u> behavior, and "receptive language" is <u>verbally controlled</u> behavior. Although these two repertoires may come to be interdependent, they are nevertheless discrete. Further, the two repertoires do not always co-exist at the same level of refinement or strength in a given individual at all times.

This becomes very apparent when we observe that a child "understands" much more than he is able to "express." The way in which we judge his "understanding" points up a useful feature of difference between the two repertoires, since the physiological requirements for demonstrating "receptive language" can center on one functioning index finger, whereas "productive language" calls on an extremely complex coordination of the articulatory organs.

There is a further, extremely important, distinction between "language" as control stimulus, and "language" as response that we will examine in some detail later, but at this point I want to offer two reasons that make this analytical distinction potent: First, it permits us to view the notion of "language" in broader behavioral terms. It frees us from the narrow point of view that someone's verbal repertoire is functioning only when he is actually speaking, and allows us to observe more meaningfully the behavior of the listener as well as that of the speaker. Second, this analysis of two repertoires leads us to the greater precision in the "specification" of behavior that our engineering approach calls for.

To complete the review of the elements of pure science that we are interested in applying requires a brief look at a set of fundamental principles in the analysis of behavior.

The principles are embodied in the notion of "three-term-contingency model" (4), and the three terms referred to are the control stimulus, the response, and the consequences to the organism of that response. We know that the nature of the consequences controls the strength, or probability of emission, of the response that immediately precedes the consequences. Control over the consequences of behavior permits us, therefore, to exercise control over the first two elements of the chain -- elements which take on special significance in an educational setting. One way of elaborating the meaning of these first two elements is to say that they are concerned with <u>bringing a specific response under the control of a specific stimulus or stimulus set</u>. In common pedagogical terms this might be exemplified by saying that a student "learns that 2 and 2 are 4." The commonly used expression -- "learning that 2 and 2 are 4" -- presents us with what would appear to be a one-piece item of learning. The analytical frame I have described above, however, discriminates between the <u>response</u> "four" and the <u>control stimulus</u> "how much are two and two?" This discrimination between control stimulus and response facilitates our teaching since it permits us to build, modify, strengthen or shift either of the two elements independently or interdependently. The response "four," for example, is appropriate

to a wide variety of control stimuli, so that "four" is the correct answer to such questions as "How much are two plus two?", "How much is five minus one?", "How many legs does a dog have?", "How many elements did the ancient Greeks recognize?", "According to Einstein and Lorenz, how many dimensions are there?", and so on. Since in all these cases the "correct" response is the same, our concern is not with the response per se, but rather with the stimulus, or question, that directs that response. It becomes obvious at this point that the task of establishing the response "four" can begin at an echoic level, that is to say, a response under the stimulus control of "Say 'four'." And it is equally obvious that unless the response has been established under the control of some stimulus, we cannot confront the task of bringing it under the control of other, more complex, or more highly valued stimuli.

What does this kind of analysis mean in terms of typical pedagogical problem with young children? Let us take a look at a hypothetical unit of "nature study" that might be relevant to a trip to the zoo: for instance, the issue of quadrupeds and bipeds in the animal kingdom. If we set out to learn how much the children "know" about animals we will be confounded by the fact that a question

such as "How many legs does a dog have?" yields the response "four," and the question "How many legs does a rhinoceros have?" also yields the correct response of "four." Apparently the children "know that a rhinoceros has four legs." But when the teacher asks a child "Can you tell me which animals have four legs?" the child responds with "dog" and "cat," but the rhinoceros is conspicuous by its absence. The situation just reported indicates that "rhinoceros" as a stimulus controls a specific response -- that is, the child's receptive repertoire includes the quadrupedal nature of the rhino. However, "rhinoceros" as a response is either absent or at low strength (under the cited stimulus control) in the child's productive repertoire. When we perceive the difference in function between a given verbal unit as a response and as a stimulus we are prepared for teaching that can be sharply focused.

Let us assume that we wish to modify the child's productive repertoire so that the response "rhinoceros" will be brought to high strength, with acceptable topography (i.e., pronunciation), under the control of specified stimuli. We are, in other words, going to "teach the child to say 'rhinoceros'."

Whether we attempt to teach him to say "rhinoceros," "elephant," "green," "rocking boat," or "cookie," it is

safe to say that we expect the child to "work" at learning the lesson. We might then ask, even though it offends some dim, Puritan ethic, "Why should the child work?" To phrase the question in behavioral terms, "What consequences support the child's extended responding to the teacher?" Verbal praise may sustain his attention and his effort for a few trials, but when his attention wanders the teacher may conclude that he "is not really motivated to learn." It is not likely to improve matters if we make the consequences more indirect and temporally distant by telling the child "If you work at this task long enough to succeed, I will tell your mother how well you are doing, and she will be proud of you."

There is an extensive body of knowledge related to the effects on behavior of positive or negative consequences, as well as the effects of different schedules of reinforcement (1). One bit of "pure science" demonstrates that although a behavior can <u>eventually</u> be sustained by intermittent, or delayed, reinforcement, it is most effectively established by immediately presenting the consequences of that behavior to the organism. This means that the child's behavior of the moment is most efficiently supported by the consequences of the immediately following moment. How long a child works at moving from "Tookie" to "Cookie" can be predicted if we know that: (a) he frequently chooses

cookies for dessert; (b) he has not recently eaten sweets; (c) there is a cookie in the teacher's hand; and (d) the delivery of the cookie is contingent upon producing a close approximation to "Cookie."

Investigation of procedures for making supportive consequences contingent upon the emission of desired behavior has led to the emergence of a field of study known as "Contingency Management" (2, 3). We will return to this subject in some detail.

We turn now to a case of a real-life educational setting in which the engineering of verbal behavior takes place. As an outgrowth of extensive work with young children carried on at the University of Rochester in the Verbal Behavior Laboratory, a preschool called the Child Language Development Center was established early in 1967. Supported by the University and the U.S. Office of Economic Opportunity, its objectives include the continuation of basic research in children's verbal behavior and the exploration of procedures for extending successful laboratory techniques to the typical preschool setting. Our pupils are drawn from the socio-economic level that characterizes the children of Project Head Start, but we have chosen to work with children who are much younger, that is, between the ages of two and three and a half.

The physical setting is generally representative of a common setting for a preschool -- a renovated private

dwelling. The main floor living room and dining room have been equipped with conventional, commercially available play apparatus, and the tables and chairs are arranged so that the living room has become the large, general-area playroom, and the dining room has become a special space for small group activities, as the starting point for the morning's activities, and later, as the dining room in which lunch is served. The school is in session four mornings a week from 10:00 a.m. until 12:30: the enrollment of approximately ten children is about equally divided between boys and girls who come from families that are white, Negro, and Negro-Asian.

The only physical part of the Child Language Development Center that differs appreciably from conventional preschool quarters is found in the use of a small room on the second floor as special space for what can be called "micro-instruction."

The essence of the strategy to be described here is in the scheme for coordinating the teaching activities of the special little room upstairs and the ordinary play space downstairs. We can begin by talking about what takes place upstairs.

The term "readiness" is a high frequency item in the lexicon of the preschool teacher, and justifiably so. What

gives the term special significance is its implication that whatever the teacher attempts to teach, she is likely to find some children prepared, or "ready" to profit from her instruction, while other children are not. "Readiness" is not often looked upon as something to be taught, but rather something that follows inevitably from physiological and social maturation in the absence of disruption or deficit, or "exposure," or "experience." This, in essence, means that we must wait for some things to "happen" so that we can teach meaningfully and profitably. As long as we talk about "readiness" we are helpless to intervene. If, instead, we examine the child's participation in our instructional program in terms of the behavioral repertoires that are requisite antecedents to it, we find we do not have to just wait. At advanced levels of education, Requisite Antecedent Behaviors are readily acknowledged, so that specified repertoires in biology and chemistry are declared requisite antecedents for a course in biochemistry. It is a little more difficult to perceive the Requisite Antecedent Behaviors (RABs) for successful participation in a preschool, and efforts at determing RABs do not often go beyond questions of toilet training. If, however, we focus on a uniformly typical activity in the preschool, such as having the children sit down around a table for stories, for snacks, for drawing, etc., we observe that entering a room, finding

a seat, or a specified seat, sitting down, staying seated for a determined length of time and attending to the teacher are not behaviors at high strength in very young children. What we have identified here is a set of sitting behaviors that are extremely important, basic, (literally fundamental) RABs for profitable participation in the preschool. True, some children may display these behaviors, but a teacher needs to have a group of children that is reliably homogeneous with regard to this repertoire if she is to pursue any program systematically.

If we need these RABs, and the children come into the school without them, how shall we establish them? Well, we know that most children eventually acquire these behaviors under a variety of stimulus controls, such as models, verbal directions, firm-but-gentle hands guiding them repeatedly to their chairs, or returning them after they have wandered away. We expect the behaviors to be maintained by the kinds of pleasant consequences that follow "coming when called," "sitting and staying seated," and "attending to the teacher." This kind of consequence control, however, is weakened by the fact that the pleasant consequences cannot occur until after the child emits the necessary behaviors. That is, if he does not stay seated long enough to hear the story, the fun of the story is not an effective reason for him to stay seated. Given stimulus controls of unpredictable strength

and consequence controls that are weak, it is not surprising that it takes a considerable length of time for these behaviors to be displayed at high levels of uniformity and reliability.

Behaviors such as these can be established rapidly and reliably by following a strategy derived from this principle: The environment in which a repertoire is appropriately displayed is not necessarily the most appropriate environment for the acquisition of the behaviors that are requisite antecedents to that repertoire. In direct, tactical, terms this means that after we have identified the RABs for a given repertoire, we can accelerate the acquisition of the complex repertoire by establishing "bits" of the RABs in a setting that is designed to be maximally effective for the acquisition of "bits." The small room apart from the play area is the place where RAB-"bits" are established, and I confess to having christened it the "RABbit Room."

Group activities taking place in the playroom are generally subject to loose stimulus control and weak consequence control. The RABbit Room is designed to provide the tightest control over all three elements of a behavioral event. The room (Figure 1), about 6 ft. x 10 ft., has a carpeted floor and is furnished with a child-size table and two chairs. On the table is a device that dispenses tokens,

in the form of 3/4 in. metal washers, when the teacher depresses a foot switch under the table. At the other end of the room, behind the child's chair, are a number of reinforcement devices that operate when the child deposits a token in a slot. All of the devices have the common characteristic of providing timed self-terminating periods of presentation of audio-visual events that have been found to function as supportive consequences for children. Typical devices placed in the room are: the Twinkle Box (Figure 2), which offers a three-second display of alternately flashing green and red star patterns on an 8 x 8 in. screen, accompanied by relay clicks; the Movie Box (Figure 3), which projects an animated cartoon on a 4 x 6 in. screen for an 8 second interval; the Slide Box (Figure 4), which projects a sequence of 35mm. color slides on a 4 x 4 in. screen. Upon insertion of a token the slide is projected for 5 seconds, and the screen goes dark. The next token produces a new slide for 5 seconds, and so on. The subject matter of the slides includes a series of brightly colored "picture book" illustrations of kittens, dogs, toys, and small children, and a series of color photographs taken of the children during a picnic.

The program of activity in the RABbit Room begins on the first day of school, and is designed to establish the

RABs for entering, finding the appropriate seat, sitting down and attending to the teacher. The program consists of the following steps:

1. The child, accompanied by his teacher, is led into the room.

2. The teacher inserts a token into one of the devices and teacher and child watch the display.

3. The child is given a token to insert in the device.

4. Attention is called to the other devices in the room, and the child is given a token to operate each one of them.

5. The teacher goes to the table and sits down in a chair, leaving vacant the chair that positions the child with his back to the reinforcement devices, while the child is still watching the display.

6. When the display ends, and the child turns to receive another token from the teacher, he is invited to come to the table for another token.

7. When the child comes to the table he is given a token.

8. After he has used the token in the device of his choice, he is invited to sit down at the table and get another token.

9. As soon as the child sits down the teacher operates the token dispenser, and the child returns to the devices at the other end of the room.

Continuing in this fashion, the child will walk to the table, sit down, and attend to the teacher for some 10 to 15 times in the initial session which lasts between 8 and 10 minutes. At the conclusion of the session the child is told that he will be invited back to the RABbit Room again, and taken back to the general play area.

On the second day, longer periods of sitting at the table are shaped, verbal control stimuli for engaging in the program ("It's time to sit at the table.") are paired with the already functioning environmental visual stimuli, verbal contingencies for reinforcement are added ("Do you want another token?" -- any sign of assent is acceptable at this point), and verbal praise is paired with the administering of tokens.

It will be worthwhile at this juncture to look at what we have accomplished in terms of our three-term contingency model for the RABs we are building here. First of all, the discrimination of the child's chair is facilitated by the fact that it is the only unoccupied chair in the room. Second, disruptive, or distracting, stimuli provided by the sight and sound of all the other children in the school are absent. Third, the contingencies for reinforcement have been gradually shifted so that he has been emitting only reinforced behavior during his brief visits to the RABbit Room. Fourth, he has emitted the desired behavior some

20 to 30 times in two school days. This is significant not only in terms of the relationship between the strength of a behavior and the number of times it is emitted and reinforced, but also in terms of contrast with the ordinary situation in which he would have to have attended school for several weeks before the behavior in question reached the same degree of strength. Fifth, verbal elements of stimulus control and reinforcement have been introduced. Sixth, the RABbit Room has become a "fun place." Since this is the setting in which the most concentrated and intensive teaching will take place, establishing the general reinforcing properties of this small "classroom" is important, not only because this supports the work done there, but also because it becomes possible to make a visit to the RABbit Room contingent on the emission of other behaviors in the downstairs playroom.

By the end of the first four days a repertoire has been established in every child consisting of entering the room, sitting down at the table, placing the hands in some rest position on the table, returning the teacher's "Good morning!" with a corresponding greeting, and remaining seated for periods of time approximating three minutes. It is time now to take this repertoire out of the RABbit Room and put it to work in the "real world" downstairs.

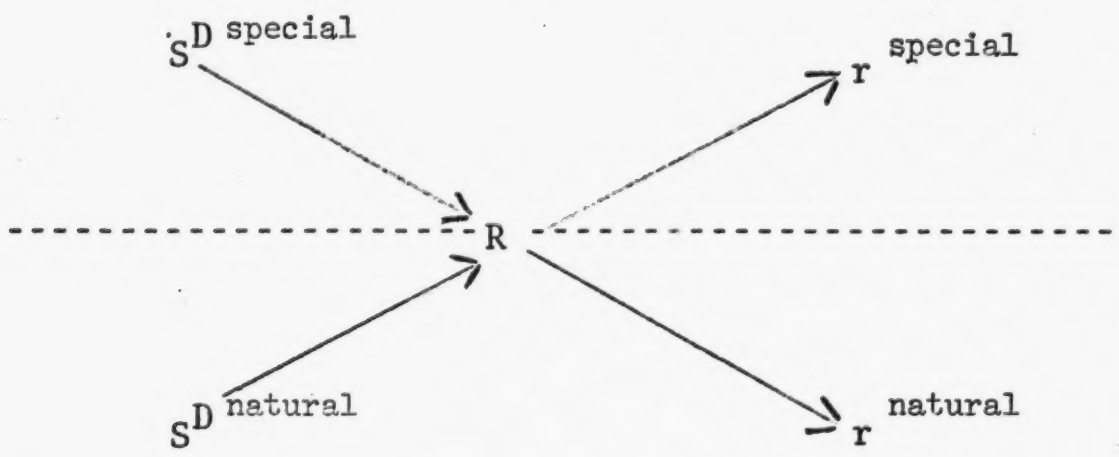
It is at this point that we can look at the beginnings of a broad process that I have labeled "Convergence Strategy."

We have indicated before that a response can be fruitfully examined in terms of either its stimulus control, consequences, or both. The repertoire of responses related to "sitting down, etc." that the child displays in the RABbit Room are under the control of stimuli specific to the RABbit Room, and these responses are supported by a variety of consequences that are also unique and specific to the RABbit Room. What we have done here is establish a repertoire of responses under the tight control of a set of special circumstances.

The example of story time given earlier reveals that we depend on the same repertoire of responses, but we expect them to be emitted under loose stimulus control, and for a set of consequences that are natural to the activity. I refer, e.g., to such consequences as the story itself, the sense of novel occasion -- "It's story time, children!" -- and a host of reinforcing events that take place in a shared experience. "Enjoying" story time, as a matter of fact, is certainly a RAB for a great many teaching activities that will come to revolve around listening and responding to a "story" told or read aloud by the teacher.

If, then, a set of responses that have been brought under control in a special setting can be made to function under the controls available in a natural setting we will have achieved a kind of convergence of two discrete pedagogical procedures in one overall management strategy.

The behavioral principles on which the strategy is based can be summarized schematically as follows:



The task of turning the strategy into a set of functioning tactics has been described with regard to the setting of the special stimulus and consequence controls for the RABs of (1) entering the room under control of teacher's verbal instructions, (2) finding seat, (3) sitting down, (4) hands engaged in non-disruptive activity, (5) attending to teacher, and (6) responding appropriately to "Good morning." This set of RABs is moved into the natural setting with the introduction into the early morning routine of an activity called Table Time I. When all the children have arrived, they assemble in the foyer outside the dining room. In the dining room is a long table, of child's height, with a chair for each child in attendance, and a teacher sitting at the head of the table. Each child is then called by name, enters the room, sits down on a chair, puts his

hands on the table, and exchanges greetings with the teacher. When all the children are seated around the table, the next activity (such as talking about the toys they want to use in the playroom) is begun. When this routine is reliably established, behavior (2) becomes the focus of interest. In Table Time I the verbal instructions "Go in and sit down." controlled entering the room, selecting an empty chair and sitting down, but there was no specific control for determining which seat was selected. The selection of this behavior for expansion provides a new set of natural consequences for the control and support of useful behaviors.

The behaviors involved in identifying one's own photograph touch on a wide spectrum of implications for social behavior as well as for a repertoire of responses under the control of pictorial stimuli. Receptive "tacting" (5) of pictures depends on a repertoire of selecting, or pointing, under the dual stimulus control of pictorial and verbal stimuli, i.e., "Point to the picture of x." in which "Point to the picture..." is a verbal control stimulus for the initiation of pointing, and the discrimination of "x" from an array of other pictures is a visual control stimulus. As those of you who have worked with very young children or with disadvantaged children know, the behaviors described above are not often at high strength in children who are both very young and who come from disadvantaged homes.

Taking this as a set of directions for establishing these behaviors as RABs, RABbit Room Program II was designed to establish discrimination of photographs of all the children and the staff members in the Child Language Development Center, and to display this discrimination under the verbal control of "Point to the picture of ____."(Figure 5).

When these RABs have been established and brought to some strength in all the children, that is, when every child can identify his own picture when presented with an array of photographs, Table Time is modified (Table Time II) so that the long table has a photo of a different child at each seating position. Verbal controls progress from "Go in and find your picture." → "Go in, find your picture and sit down at your picture." → "Go in and sit down at your picture." → "Go in and sit down at your place." The child thus enters the room, walks around the table scanning the photos, finds his photograph and sits down in front of it. Table Time then continues as before.

It has become apparent that the task of finding one's seat by searching for appropriate cues is a reinforcing event in and of itself, requiring no extrinsic reinforcement to maintain it. Evidence from this and other similar experiences supports the conclusion that whenever a previously irrelevant set of stimulus properties acquires discriminative function, the act of coming under the control

of these stimuli becomes a high probability, i.e., reinforcing, event. The phenomenon is popularly recognized as the "fun" in engaging in a newly established skill, or in looking at objects to "practice" newly learned discriminiations. The man who has just learned about the tiny mint marks on coins spends more time looking at coins than he ever did before, and children who have learned to discriminate fine details in one set of pictures are more likely to attend to pictures in general.

From the examples of the convergence of individual training in the RABbit Room with group activities in general preschool environment a pattern of "flow" can be seen, i.e., analysis of school-type behavior ⟶ identification of RABs ⟶ baseline testing of children for RABs ⟶ RABbit Room sessions with each child as needed to establish RABs (individual instruction) ⟶ providing school (group) activity that draws upon established RABs and brings the behavior under the control of natural stimuli and consequences ⟶ establishment of more sophisticated RABs for additional school activities ⟶ repeat cycle.

Figure 6 outlines the strategy and specifies the tactics that have been developed for establishing a receptive repertoire of ten colors, and bringing the repertoire to full functioning strength under natural controls. The terminal behavior is specified in terms of the controls:

"Point to ...," "Find...," etc., object (already in child's repertoire) of specific "color." e.g., "Sit on the green bench." Verbal S^Ds are: red, blue, green, yellow, orange, pink, purple, brown, black and white.

The boxes on the left identify the RABbit Room Program and the behavior to be established. Each Program has as RABs the behaviors established in all the preceding RABbit Room Programs. The boxes on the right identify Programs that are carried out in the Playroom or the Dining Room. As with the RABbit Room Programs, the last Program depends on the behaviors brought to strength in preceding Programs. We have talked about several of the Programs on both sides of the line, and although I cannot fully detail here all of the activities referred to, it will be of particular interest to look at the shift in critical verbal and visual control stimuli for the beginning of Table Time III, IV, and V. We are still focusing on "finding one's seat," but the arrangement has been modified so that the children are no longer sitting on their usual folding chairs. Instead, there are ten wooden benches, approximately cubical, and each bench is painted with one of the ten colors listed earlier. A set of color plaques, consisting of 4 x 5 in. pieces of Masonite, have been painted with the same colors used on the benches. For Program III, each child is given

a color plaque at the doorway, and told to "Sit down on the bench that matches this color." The child takes the plaque with him to find his bench. For Program IV, the child is shown the plaque and told to "Sit on the bench that matches this color." He looks at the plaque before he enters the room, but does not take the plaque with him. For Program V no plaques are used and the child is told to "Sit on the green, red, yellow, etc., bench."

The procedures for establishing a carefully defined set of behaviors have been presented in some detail, but the levels of description given so far do not yet meet the engineering criteria needed for repeatability. For the specifications to be truly adequate, we need the equivalent of "working drawings" for the Programs assigned to each box on the chart. The full specification of the procedures followed to establish the RABs for each box represent a small unit of "programmed instruction" in the sense that: (1) we have attempted to exercise precise control over those elements that contribute to reaching the target behaviors; (2) the identification of these elements has been empirically determined; (3) the success of the program is not sensitive to changes in teaching personnel.

The last point is crucial to the notion of repeatability. One of the most serious problems in teaching appears in the difficulties found in generalizing the success of

one procedure or another. To hear, at a professional meeting , some teachers' reports of successful use of Dr. X's "method," and other teachers' reports of its dismal failure, does not mean that Dr. X has been dishonest in reporting his success and encouraging wide use of his "method." It may mean that Dr. X has not reported his procedures in sufficient detail so that an attempt to replicate his work is <u>really</u> a replication, and not just a rough approximation. It may also mean that the successes achieved depend on some properties of the behavior of Dr. X that he has failed to identify as a critical factor of his work. In this case, those teachers who <u>happen</u> to behave as Dr. X did find his "method" successful -- and other teachers do not.

When we are concerned with a repertoire of behaviors that are evaluated in terms of fine distinctions, as is verbal behavior, attention to fine details in establishing the behaviors becomes critical. We have applied concentrated effort to the specification of those aspects of the verbal control stimulus that are relevant to a given behavior so that, although the teacher's "style" may vary in many dimensions, the child will still emit the target behaviors. An example of this kind of specification is found in the Program called "Mystery Matching Box I," part of the sequence for establishing matching-to-sample behavior, and bringing such behavior under the verbal controls of the

words "match," "matching," etc., and represents a kind of behavioral "recipe," or set of instructions, for establishing a particular set of behaviors.

The reliability of the procedures, and the feasibility of their application has been developed and tested to date through three preschool classes and across ten teachers whose training and experience in preschool education ranged from zero to very little, and whose academic preparation ranged from high school graduates to Ph.D. candidates. That inexperienced people who have been taught to administer the programs can lead children to full criterion behavior has encouraging implications for solving staffing problems created by the rapid growth of interest in and appreciation of the importance of early childhood education.

The examples of preschool behaviors we have discussed today have been limited to only a few of the many we are actually working with at the Child Language Development Center, but I hope they have served to demonstrate the principles and the processes involved in my efforts to make preschool education definable, achievable, and, most significantly, repeatable.

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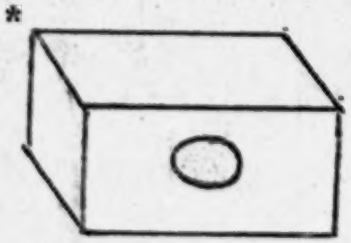
MYSTERY MATCHING BOX 1

CLDC Program

Materials: Matching Box; 2 teaspoons; 2 blunt, dull knives; 2 small forks; 2 wooden cubes, 1 in.; 2 ping pong balls; 2 boxes, jeweler's gift, approx.1-1/2 in.; and M&M candy.

* 	"There is something inside this box that you can't see. If you put your hand in the hole, you can <u>feel</u> what's inside. Can you show me where the hole is?"	(any manner of pointing)	
(Teaspoon in the box)	"Put your hand in the hole, and take out what's inside the box."	--- retrieves ---	Verbal reinforcement "Good!"
	"What is it?"	"Spoon"	(Prompt if needed) "That's right!"
	"Will you give me the spoon, please?"	--- gives ---	"Thank you!"
(E puts a knife in the back of box)	"There's something else in the box now. Take it out!"	--- retrieves ---	"Fine!"
	"What is it?"	"Knife"	"Yes! That's a knife!" (or prompt model)
	"Will you give me the knife, please?"	--- gives ---	"Thank you!"
(Spoon and knife inserted in box from rear.) E shows S a spoon.	"Here is a spoon. Can you put your hand in the box and find <u>another</u> spoon"	--- retrieves ---	
(When spoon is retrieved ask S to show it)	"What have you got?"	--- (a, another, spoon)	Verbal reinforcement
	"Will you give me the spoon, please?"	--- gives ---	"Thank you!"

* Rear of box has hinged door.

(Spoon and knife inserted in box from rear) E shows S knife.	"Here is a knife. Can you find another knife in the box?"	--- retrieves ---	Verbal reinforcement
	"Will you give me the knife, please?"	--- gives ---	"Thank you!"
(Box contains knife, fork, and spoon) Show S a fork.	"Here's a fork. Put your hand in the box and take out a fork just like this one."	--- retrieves ---	Verbal reinforcement
	"Will you give me the fork?"	--- gives ---	"Thank you."
(Box contains knife, fork, and small cup) Show S the cup.	"Can you find something in the box just like this?"	--- retrieves ---	Verbal reinforcement
	"Will you give me the cup, please?"	--- gives ---	"Thank you!"
(Small block ... 1 in. cube and spoon and knife in box) Show cube.	"Now look what I've got. Can you find something in the box that matches this?"	--- retrieves ---	Verbal reinforcement
	"Will you give me the block, please?"	--- gives ---	"Thank you!"
(Ping pong ball, fork and knife in box) Hold up the ball.	"Can you find something in the box that matches this?"	--- retrieves ---	Verbal reinforcement
	"Will you give me the ball, please?"	--- gives ---	"Thank you!"
(Cardboard jeweler's giftbox, with M&M inside and ball and spoon in box) Hold up gift box.	"Now here's a big surprise! Can you find something in the box that matches this?"	--- retrieves ---	Verbal reinforcement
	"If you open the little box, you may have what's inside."	S opens box, discovers candy, and is permitted (encouraged) to eat it.	
TERMINATE PROGRAM	"We'll do it again tomorrow (or soon)."		

ACQUISITION

SPECIAL CONTROLS

(RABbit Room)

RRI
enter, sit,
attend,
greeting

RR II
receptive
tacting
of photos

Table
Time I

RR III
matching
to sample
(pictures)

Table
Time II

RR IV
matching
to sample
(objects)

Matching
Game I
pictures

RR V
matching to
present sample
(color)

Matching
Game II

RR VI
matching to
absent sample
(color)

Table
Time III

RR VII
receptive
tacting
(color)

Table
Time IV

Table
Time V

DISPLAY

NATURAL CONTROLS

(Playroom and Dining Room)

Figure 6